

**CLAIMS**

1. A free-piston Stirling engine comprising:  
a pressure container filled with a working gas;  
5 a cylinder secured inside the pressure container;  
a power piston provided inside the cylinder; and  
a displacer provided inside the cylinder on a same axis as the power piston and  
elastically supported with a supporting spring,

wherein the pressure container comprises: a work space located on a displacer piston  
10 side of the power piston; and a back-pressure space located on a side of the power piston  
opposite to the work space,

wherein the displacer comprises: a displacer piston that slides inside the cylinder; and  
a rod which is connected and fixed to the displacer piston and placed through a slide hole  
formed at a center of the power piston, and

15 wherein the rod is formed in a shape of a hollow pipe.

2. A free-piston Stirling engine comprising:  
a pressure container filled with a working gas;  
a cylinder secured inside the pressure container;  
20 a power piston provided inside the cylinder; and  
a displacer provided inside the cylinder on a same axis as the power piston and  
elastically supported with a supporting spring,

wherein the pressure container comprises: a work space located on a displacer piston  
side of the power piston; and a back-pressure space located on a side of the power piston

opposite to the work space,

wherein the displacer comprises: a displacer piston that slides inside the cylinder; and a rod which is connected and fixed to the displacer piston and placed through a slide hole formed at a center of the power piston, and

5        wherein the rod is formed in a shape of a hollow pipe to make the displacer lighter and thereby increase a resonance frequency thereof.

3. The Stirling engine according to claim 1 or 2,

wherein the displacer piston has a hollow space inside,

10        wherein the displacer piston has formed therein: one or more than one inlet via which the working gas flows into the hollow space inside the piston; and one or more than one outlet via which the gas having flowed into the hollow space flows out of the hollow space,

      wherein the inlet is formed in a wall surface to which the rod is connected, the inlet penetrating the wall surface from outside the wall surface into the hollow space,

15        wherein the outlet is formed in a side circumferential wall of the displacer piston, the outlet penetrating the side circumferential wall from the hollow space to outside an outer circumferential surface of the displacer piston, and

      wherein there is provided means for preventing the working gas from flowing between the work space and the back-pressure space via the hollow space inside the rod.

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4. The Stirling engine according to claim 3,

      wherein the means for preventing gas flow prevents gas flow between the hollow space inside the displacer piston and the hollow space inside the rod.

5. A free-piston Stirling engine comprising:
  - a pressure container filled with a working gas;
  - a cylinder secured inside the pressure container;
  - a power piston provided inside the cylinder; and
  - 5 a displacer provided inside the cylinder on a same axis as the power piston and elastically supported with a supporting spring,
    - wherein the pressure container comprises: a work space located on a displacer piston side of the power piston; and a back-pressure space located on a side of the power piston opposite to the work space,
- 10 wherein the displacer comprises: a displacer piston sliding inside the cylinder and having a hollow space inside; and a rod which is placed through a slide hole formed at a center of the power piston,
  - wherein the displacer piston has a hollow space inside,
  - wherein the displacer piston has formed therein: one or more than one inlet via which
- 15 the working gas flows into the hollow space inside the piston; and one or more than one outlet via which the gas having flowed into the hollow space flows out of the hollow space,
  - wherein the inlet is formed in a wall surface to which the rod is connected, the inlet penetrating the wall surface from outside the wall into the hollow space,
  - wherein the outlet is formed so as to penetrate the displacer piston from the hollow
- 20 space inside the displacer piston to outside an outer circumferential surface thereof,
  - wherein the rod is formed in a shape of a hollow pipe,
  - wherein there is provided, in a part of the hollow space inside the rod located away from the outlet with respect to the displacer piston, means for preventing the working gas from flowing between the work space and the back-pressure space, and

wherein there is provided, in a circumferential side wall of a part of the rod inserted in the slide hole, one or more than one gas outlet formed and penetrate, in a direction of a radius of the rod, the circumferential side wall from the hollow space to outside an outer circumferential surface thereof.